AMENDMENT TO THE CLAIMS

The following listing of claims replaces all prior versions and listings in the application:

Listing of Claims:

1. (Currently Amended) A complex sigma-delta modulation method, comprising:

receiving an input signal; ~~a complex input signal having a real component and an imaginary component~~;

mixing the input signal with oscillator signals to produce a complex asymmetric input signal having a real component and an imaginary component;

applying a first complex sigma-delta modulation process to the complex asymmetric input signal to produce a first sigma-delta modulated signal;

applying a second complex sigma-delta modulation process to the first sigma-delta modulated signal to produce a second sigma-delta modulated signal; and

conditioning the first and second sigma-delta modulated signals using a complex noise cancellation process to produce an output signal.

2. (Previously Presented) The complex modulation method of claim 1, the first and second complex sigma-delta modulation processes each comprising multiple-order sigma-delta modulation processes.

3. (Currently Amended) The method of claim 1, the receiving step comprising[[:]]

receiving a radio frequency modulated signal~~; and~~

~~down-converting the radio frequency modulated signal to produce the complex input signal~~.

4. (Currently Amended) The complex modulation method of claim 3, the mixing ~~down-converting~~ step comprising:

mixing the radio frequency modulated signal with first and second quadrature local oscillator signals to produce the complex input signal.

5. (Currently Amended) An analog-to-digital converter, comprising:

an input for receiving an input signal ~~having real and imaginary components~~;

a mixer for mixing the input signal with oscillator signals to produce a complex asymmetric input signal having a real component and an imaginary component;

a first complex sigma-delta modulator for modulating the complex asymmetric input signal to produce a first sigma-delta modulated output signal;

a second complex sigma-delta modulator coupled to the first complex sigma-delta modulator, for converting the first sigma-delta modulated signal into a second sigma-delta modulated signal; and

a complex digital noise cancellation circuit, coupled to the first and second complex sigma-delta modulators, for canceling quantization noise and to produce a converter output signal from the first and second sigma-delta modulated output signals.

6. (Previously Presented) The analog-to-digital converter of claim 5, the first and second sigma-delta modulators including real integrators.

7. (Previously Presented) The analog-to-digital converter of claim 5, the first complex sigma-delta modulator comprising a multiple-order sigma-delta modulator circuit.

8. (Previously Presented) The analog-to-digital converter of claim 7, the multiple-order sigma-delta modulator circuit including real integrators.

9. (Previously Presented) The analog-to-digital converter of claim 5, the second complex sigma-delta modulator comprising a multiple-order sigma-delta modulator circuit.

10. (Previously Presented) The analog-to-digital converter of claim 9, the multiple-order sigma-delta modulator circuit including real integrators.

11. (Currently Amended) A complex modulator, comprising:

an input for receiving an input signal;

a mixer for mixing the input signal with oscillator signals to produce [[a]] an asymmetric baseband input signal having a real and an imaginary component;

a complex analog-to-digital converter for converting one of the real and imaginary components of the asymmetric baseband input signal into a quantized real output signal and a quantized imaginary output signal; and

a complex digital filter for filtering the complex real and imaginary output signals to produce a real filtered output signal.

12. (Previously Presented) The complex modulator of claim 11, the complex analog-to-digital converter, comprising:

a first complex sigma-delta modulator for converting the one of the real and imaginary components of the input signal to produce a first sigma-delta modulated output signal; and

a second complex sigma-delta modulator coupled to the first complex sigma-delta modulator, for converting the first sigma-delta modulated signal into the quantized real output signal and the quantized imaginary output signal.

13. (Previously Presented) The complex modulator of claim 11, further comprising:

a radio frequency signal receiver for ~~producing the baseband~~ receiving a radio frequency input signal.

14. (Currently Amended) The complex modulator of claim 13, the radio frequency receiver comprising:

an antenna circuit coupled to the mixers for receiving a modulated radio frequency ~~signal ; and a~~ signal, the mixers ~~down-converter, coupled to the antenna circuit, for~~ converting the modulated radio frequency signal into [[a]] an asymmetric baseband signal centered about DC.

15. (Currently Amended) The complex modulator of claim 14, ~~the down-converter comprising: a~~ the mixer [[for]] mixing the modulated radio frequency signal with first and second quadrature local oscillator signals to produce the asymmetric baseband input signal.

16. (Currently Amended) A radio frequency receiver, comprising:

an input for receiving a modulated radio frequency signal;

a down converter coupled to the input for ~~converting~~ mixing the modulated radio frequency signal with oscillating signals to produce [[into]] an asymmetric input signal having real and imaginary components;

an analog to digital converter coupled to the down converter, comprising:

a first stage including a complex sigma-delta modulator and having a first stage output; and

a second stage coupled to the output of the first stage including a complex sigma delta modulator, and having a second stage output; and

a complex digital noise cancellation circuit coupled to the outputs of the first and second stages, for canceling quantization noise and for producing a digitized output signal.

17. (Currently Amended) A radio frequency receiver, comprising:

an input for receiving a modulated radio frequency signal;

a down converter coupled to the input for ~~converting~~ mixing the modulated radio frequency signal with oscillating signals to produce ~~into a~~ an asymmetric baseband input signal having real and imaginary components;

a complex sigma-delta analog to digital converter coupled to the down converter, for converting only one of the real and imaginary components of the input signal into a complex digitized output signal; and

a complex digital filter coupled to the complex sigma-delta analog to digital converter, for producing a real filtered output signal from the complex digitized output signal.

18. (New) The complex modulation of claim 1, the asymmetric signal comprising positive frequencies.

19. (New) The complex modulation of claim 1, the asymmetric signal comprising negative frequencies.